DENTISTRY

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Increasing The Width Of Keratinized Tissue Using the Nd: YAG Laser

GILIO, Douglas Visalia, CA USA

This new surgical technique will discuss the use of Nd: YAG laser using touch tip control fiber-optics to increase the zone of keratinized tissue. The surgical laser treatment provided for epithelial cell migration under a protective cover of GTM. Using power parameters of 3-6 watts continous settings and the touch tip fiber-optic a tension release mucogingival flap was created, with periosteum intact. Data is presented from 30 patients using facial surfaces with inadequate keratinized gingiva. The results indicated that the zone of keratinized tissue was increased an average of 3.8mm using the Nd: YAG laser in conjunction with GTM placed over the surgical bed.

This study would indicate that facial gingival surfaces with minimial attached keratinized gingiva can be increased using GTM and the Nd: YAG laser as a tissue cutting instrument.

***GTM Guided tissue membrane**

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ORAL SURGICAL PROCEDURES WITH THE HOLMIUM:YAG LASER

Emile Martin, Syracuse, NY

The holmium:YAG wavelength (2090nm) is an excellent instrument for oral surgical procedures. It provides the clinician with increased surgical speed in comparison to Nd:YAG while offering the convenience of a fiber optic delivery mechanism. Multiple soft tissue surgical cases are presented to show the versatility of this wavelength. In addition, the presentation will include documentation of implant exposures where considered appropriate by the clinician. Examples of soft tissue biopsies will be shown to demonstrate the efficacy of performing these procedures while providing the oral pathologist with tissue samples that can be correctly interpreted.

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LASER ASSISTED PERIODONTAL THERAPY

TED I.FRENCH ,ARLINGTON,TEXAS

Case study showing periodontal reattachment and bone regeneration after laser assisted periodontal therapy. Sulcular debridement using "free-running" dual pulsed Nd:Yag laser,root scaling with Piezon scaler and irrigation with antimicrobial solutions, bite adjustment and occlusal splinting,and coagulation of pocket blood vessels using same laser. Periodontal reattachment as evident in photographs and radiographs showing periodontal probing around each tooth. Reductions of periodontal pockets.The average pockets reduction was 2.2mm. Reduction of cold sensitivity.

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Switchable Multi-Wavelength Laser (Er:/Ho:YAG)

Craig B. Gimbel
Hewitt, New Jersey

National Aeronautics and Space Administration (NASA) technology is being used to develop a laser which we only dreamed could be possible for the next millennium (a joint venture of NASA and Lantis Laser, Inc.). Currently two different lasers are required for FDA-cleared hard and soft tissue procedures. Different wavelengths have a different absorption, depth of penetration and either a photothermal or photoacoustical effect However, the cost, treatment room space and maintenance of two separate laser devices are generally prohibitive. The development of a switchable multi-wavelength laser which shares components including one laser rod and cavity is a landmark development in the field of photonics with a major impact for the dental and medical profession. Initially, erbium (2940nm) and holmium (2100nm) wavelengths will be able to be controlled. Distinct separate and blended wavelengths are capable of being controlled with the touch of a switch. New applications could be possible due to the ability to blend different wavelengths pulses and pulse widths. Through the utilization of one common delivery system, which is dependable and cost-effective, the functionality and simplicity of the dental laser will be taken to new heights.

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MICROLEAKAGE OF COMPOSITE RESTORATIONS IN ER,CR:YSGG LASER PREPARED CLASS II CAVITIES

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Objective: The aim of this study was to investigate the microleakage of directly placed Class II composite resin restorations in Er,Cr:YSGG laser prepared cavities in vitro. The results have been compared to composite restorations in conventionally prepared class II cavities using a high speed burr and acid etching. *Methods:* 24 human extracted teeth were used in this study. The teeth were divided into three groups. Class II cavities of the same size were then prepared. The teeth of group I and II were prepared with an Er,Cr:YSGG laser, the teeth of group III were prepared conventionally with a high speed drill (control). The cavity margins of group I and III were etched with 37% phosphoric acid. After the cavities were filled with composite resin, the teeth were stored in

saline solution, thermocycled, placed in dye solution and sectioned in longitudinal and bucco-lingual direction. The slices were evaluated by light microscopy. *Results:* Er,Cr:YSGG laser prepared cavities without the use of acid etching showed severe microleakage. The conventionally prepared restorations showed the best results. *Conclusion:* After using an Er,Cr:YSGG laser for cavity preparation the margins should be etched to reach a comparable result to the conventional acid etching technique.

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MEASUREMENTS OF THE OPTICAL PROPERTIES OF DENTINE

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G.Pearson, J.Williams, Eastman Dental Institute, London, UK.

The scattering and absorption characteristics for sound dentine and dentine in various stages of demineralisation were investigated. A laser source consisting of a visible laser diode, a lensing assembly and fibre optic delivery was designed and used to investigate the properties of dentine. Dentine samples consisting of discs cut horizontally through the crown of the tooth and discs cut vertically down the length of the tooth from the crown to the root were used so that the orientation of the tubules could be considered. The test sample consisted of 7 horizontal discs and 5 vertical discs, of different thickness ranging from 0.3mm to 2.2mm. All of the dentine discs were measured prior to demineralisation then measured at various stages throughout the demineralisation process. The effect of the smear layer was also investigated to assess its influence on the change in the surface characteristics.

To extend the measurements to be representative of an actual tooth, dentine blocks ~6mm x 5mm x 3mm were cut from the crown area of the tooth. A small hole ~850μm in diameter was drilled in the centre of the block to allow the insertion of a ~800μm diameter isotropic illuminator at the distal end of a fibre. The tooth was then scanned through 360° to record the transmission characteristics. A total of 8 blocks were investigated. The blocks were subjected to the same demineralisation process as the discs and the surface and bulk effects investigated.

The results demonstrate changes in the surface and bulk optical properties during the demineralisation process and identify at what stage full demineralisation occurred. Quantitative values for surface and bulk absorption/scattering coefficients were determined.

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TREATMENT OF LEUKOPLAKIA AND HEMANGIOMAS USING THE COMBINED Er:YAG / Nd:YAG LASER

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PURPOSE: Leukoplakia and hemangiomas are both common entities in oral pathology. Their treatment, however, still presents a challenge in everyday surgical practice. This study was performed to establish optimal laser parameters for treatment of both lesions.

METHODS: Using the combined Fotona Twinlight Er:YAG/Nd:YAG laser, seven patients with leukoplakia and eight patients with intraoral or vermilion hemangiomas were treated in the period of six months. All of the leukoplakias were histologically proved benign prior to treatment. Er:YAG laser was used for ablation of leukoplakia, beam energy ranging from 400 to 800 mJ, frequency ranging from 6 to 8 Hz, spot diameter ranging from 2 to 5 mm. Affected mucosa was ablated on a layer by layer basis, down to the depth of petechial bleeding. Nd:YAG laser was used for coagulation of hemangiomas, beam power ranging from 6 to 10 W, frequency ranging from 35 to 50 Hz, spot diameter being a constant 320 μm. Topical or infiltrational anesthesia with 2% Xylocain was used. All of the cases were treated on an outpatient basis.

RESULTS: Leukoplakias required 2 to 4 treatments, energy densities higher than 4 J/cm^2 were necessary for effective removal of lesions. Hemangiomas all required only a single treatment, with beam power higher than 8 W necessary for thorough coagulation. None of the patients had any signifficant complications or discomfort. Laser induced wounds healed in 7 to 20 days, depending on the size and depth of the lesion.

CONCLUSION: The combined Twinlight Er:YAG/Nd:YAG laser, with properly selected parameters, proved to be a useful tool for treatment of both pathological entities.

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Clinical and Experimental Research of New Laser Technology on Preventation and Treatment of Oral Cavity Diseases

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ABSTRACT

Toothbrush, as one of the components of multi-functional laser beauty health instrument, is a creativeness of application of new laser technology. The mechanism of 650nm Diode laser to prevent and treat oral cavity diseases is: low power laser given off by brush and photo-conducter material irradiate teeh and oral cavity soft tissue when teeh surface were rub, this strength the bioeffect of laser to oral cavity. Clinical and experimental results showed: It can prevent and treat oral ulcer, periodontoclasia,acute and chronic pharyngitis. If used with laser whitening agent, it will receive clean and whitening effect gradually,because the photochemical function of laser has effect on yellow-spotted teeh and mild"tetracycline". The results showed: the SOD level can be improved when using 650nm low power laser to irradiate oral cavity. Statistic analysis showed: P<0.01. At the same time it can change hemorheology and blood microcirculation. Statistic analysis showed:P<0.05. So we think laser toothbrush has significance to promote the miniaturization, application and familization of laser medical technology. It has brilliant future.

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LASER APPLICATIONS AND BENEFITS FOR INTRAORAL LESIONS

Hong-Sai Loh, National University of Singapore, Singapore

In Singapore, the effectiveness of laser applications in dentistry was reported eleven years ago (Loh and Keng 1989). Favorable tissue responses in terms of post-operative pain, bleeding and swelling were achieved with reduced instrumentation and dysfunctions. Experi-

ences with different lasers in the treatment for tissue hyperplasia, leukoplakia, lichen planus, and hemorrhagic disorders affirm their significant advantages (Pick, Pogrel and Loh 1995). A clinical investigation of the laser management of oral lichen planus suggested immunomodulation in providing symptomatic relief and improvements (Loh 1992). Beneficial effects of laser management of oral vascular-related lesions include reduced scarring and trismus (Loh and Tan 1997). CO_2 laser application in apical surgery for root-filled teeth was effective in the elimination of infection and minimized destruction of apex and bone (Loh 1998).

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LASER ASSISTED COSMETIC DENTISTRY

Robert Reyto, Beverly Hills CA

Dentistry has gone through a revolution during the past 20 years. New materials, equipment and techniques allow us to provide better care, more esthetic restorations and improved appearance. As a result of the advanced technology, patients report increased self-esteem, confidence, and with implants they can enjoy worry-free eating.

The wonderful world of cosmetic enhancements with dental lasers, including tooth whitening, gingival contouring and cavity preparation, are presented from this dentist's point of view.

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PINERO PRECARDIAC SURGICAL PROTOCOL IN THE PREVENTION OF BACTEREMIA PRIOR TO CARDIOVASCULAR SURGERY

Jorge Pinero
St. Lukes Medical Center, Milwaukee, Wisconsin

The purpose of this study is to show a significant advantage of NdYag laser usage in the treatment of Periodontal Infection prior to Cardiovascular surgery by substantially reducing orally induced bacteremias.

From the oral cavity, oral organisms have been traced to the heart. The consequences often have been fatal-mediastinitis endocarditis, myocarditis and the most well known, bacterial endocarditis.

Transient bacteremias are associated with extraction of teeth and periodontal treatment. Positive blood cultures in post extraction blood cultures average about 52% which is considerably higher than the 10-15% positive cultures reported for suspected bacteremias unassociated with surgery.

The use of an NdYag laser has proven useful in the substantial reduction of post extraction and post periodontal surgery bacteremias in patents to undergo Cardiovascular Surgery. The NdYag laser is utilized in a curettage surgical procedure completely circumscribing any teeth in the oral cavity prior to extraction or oral surgical procedure. The lasers ability to provide a bloodless field and sterility by ablation of cells and cell nucleus including those of bacteria that come in contact with the beam path.

The results show 345 patients treated with this protocol show a 0% bacteremia post extraction and post periodontal surgery. Preoperative and post operative blood cultures demonstrated the significant decrease in bacteremias from the use of this protocol. The conclusion is a dramatic reduction of bacteremias after dental therapy in periodontally infected patients prior to the Cardiovascular surgery. This protocol shows a superior approach to treating oral infections in patients awaiting Cardiovascular surgery than the conventional non-laser approach.

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LASER PALLIATION OF THE AIDS PATIENT

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New York Hospital-Medical Center
Flushing, New York

More than 95% of patients with Acquired Immunodeficiency Syndrome have oral manifestations of the disease during the course of their illness. In most patients that are HIV positive or suffering from AIDS, oral diseases are the most common early signs of infection. These oral manifestations can impede chewing and swallowing, which seriously impairs nutritional intake. This is a potentially life-threatening development in a patient who may already be suffering from AIDS-related wasting disease. Many of these oral manifestations can be treated, improving the quality of life of these patients. Laser treatment of these oral diseases can be an efficient and bloodless way of providing a needed service to these patients. This presentation will discuss the oral manifestations of AIDS, their diagnosis, and treatment with laser energy. Among the lesions that will be discussed are the following:

Kaposi's Sarcoma
Human Papilloma Virus
Herpetic Stomatitis
Recurrent Aphthous Stomatitis
Linear Gingival Erythema (HIV-G)
Necrotizing Ulcerative Periodontitis (HIV-P)
Acute Necrotizing Ulcerative Gingivitis (ANUG)

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LASER TREATMENT FOR HEADACHES OF NEUROGENIC AND NEUROMUSCULAR ORIGIN

Edmund S.P. Wong, Honolulu, Hawaii

Lower level lasers when used properly are one of the most effective, nonevasive, drugless and painless modality of treatment for this malady. The rationale for its use is based on certain known physiological facts: 1) All pains are the result of tissue injury caused by one or more of the following stimuli: a) mechanical b) thermal c) chemical. 2) Chemical stimulus is most sensitive to the "C" fiber nerve endings which accounts for the vast majority of all pains. 3) Neurogenic "C" fiber pains are the direct result of noxious chemical that are released at the site of injury most frequently at the periosteal-osseous junction by way of Sharpey's fiber. 4) The lymphatic system is the most effective physiological approach of evacuating the noxious chemicals, (Kinin, Brady Kinin, etc.). 5) Neuro-muscular pains (trigger point)

are the direct result of neurogenic stimulation by way of the withdrawal reflex. Conclusion: Lower level laser when directed at the site of injury releases endorphins which inhibits the pain stimulus and nervous system which immediately evacuates the headaches of neurogenic and neuro-muscular origin.

DERMATOLOGY/ PLASTIC SURGERY

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COLLAGEN TIGHTENING INDUCED BY CARBON DIOXIDE LASER VERSUS ERBIUM:YAG LASER. **Richard E. Fitzpatrick, Nancy Marchell, Elizabeth Rostan. Dermatology Associates of San Diego County, Inc., La Jolla, CA**

Purpose: This study was performed to determine if there is a difference in skin tightening secondary to thermally mediated collagen contraction versus that which occurs secondary to tissue contraction of wound healing. The persistence of these changes over six months and the histological characteristics were studied as well.

Method: Nine patients had four tattoo dots applied to the upper eyelids, with horizontal axis measuring 15-20 mm and the vertical axis 7-10 mm. One month later one eyelid was treated with three passes of the UltraPulse CO_2 laser and the other eyelid with an erbium laser to the endpoint of early pinpoint bleeding. Measurements of the vertical and horizontal distances were made after each pass and monthly for six months. The treated skin was then excised in performance of an upper lip blepharoplasty and the tissue submitted for histological analysis.

Results: In the vertical plane the Ultrapulse CO_2 laser induced an average of 43% tightening intra-operatively and this gradually diminished to an average of 37% by six months, while the wound contracture of erbium resurfacing was not seen until one month post-op, at which time 42% tightening was seen, gradually diminishing to 37% at six months. Two patients with erbium resurfacing had scarring present. In the horizontal plane, the CO_2 laser caused 31% intra-operative tightening, decreasing to 20% at six months. In this plane, the erbium laser induced wound contracture of 11% at one month, increasing to 15% at 6 months.

Conclusions: Though wound contraction secondary to tissue healing may result in nearly the same tissue tightening as heat-induced collagen contraction, the two processes are very different and variable, with risk of scarring occurring. The tissue tightening seen with thermally induced collagen contraction is long-lasting, if not "permanent".

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ABSTRACT TITLE: COMPARISON OF $UPCO_2$ FOLLOWED BY SIMULTANEOUS ERBIUM:YAG LASER RESURFACING WITH SCITON CONTOUR™ COMBINATION ERBIUM:YAG LASER RESURFACING

Authors: Mitchel P. Goldman, M.D.; Richard E. Fitzpatrick, M.D.; Elizabeth F. Rostan, M.D.

STATEMENT OF PURPOSE: To compare two laser resurfacing modalities regarding wound healing and improvement of photodamage.

METHODS OF STUDY: 18 patients received full-face laser resurfacing with one side of the face resurfaced with the UltraPulse CO_2 laser at 300mJ using a CPG at a density setting of six followed by a density setting of five followed by Erbium:YAG at 10J/cm² times two passes. The alternate side of the face was treated with the Sciton blended Erbium:YAG Contour™ laser at 16J of ablation and 100μ of coag times two passes followed by Erbium:YAG at 10J/cm² times two passes. Patients were followed at one, two, four, eight, and twelve weeks, and clinical efficacy, as well as adverse effects, were noted. All patients had a 2mm punch biopsy taken immediately following laser resurfacing. Eight patients had an additional biopsy taken at the twelve week follow up period.

SUMMARY OF RESULTS: There were no significant clinical differences in the adverse sequela (bleeding, edema, erythema, and healing rate) between either laser resurfacing modality. Although no significant difference was noted between overall clinical improvement, a slight trend was present towards decreased photo-aging score in patients treated with the combination $UPCO_2$ following by Er:YAG laser resurfacing. Histologic evaluation showed identical, non-specific thermal damage from these two modalities. However, histologic examination of two passes with the Sciton Contour™ laser compared to two passes with the $UPCO_2$ laser (without the additional two passes of the Erbium:YAG laser) showed approximately a 2.4 x increase in thermal damage with the $UPCO_2$ laser alone as compared to the Sciton Contour™ laser alone.

CONCLUSIONS: The Sciton Contour™blended Erbium:YAG laser can achieve similar results to the $UPCO_2$ followed by Erbium:YAG laser resurfacing. However, some patients note an increased efficacy especially in evaluating peri-orbital rhytidities and peri-oral rhytidities with the combination $UPCO_2$ followed by Erbium:YAG resurfacing.

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EFFECT OF VARIED PULSE DURATION AND FLUENCE OF THE CO3 LASER ON COAGULATION AND DEPTH OF COLLAGEN CONTRACTION. Brian Zelickson and David Kist, University of Minnesota Department of Dermatology, Minneapolis, MN.

Purpose: The purpose of this study was to evaluate the effects of varying the fluence and pulse duration of the CO3 erbium YAG laser (Cynosure, Chelmsford, MA).

Methods: Fresh bovine tendon was obtained, divided into 1 cm squares, and exposed to the following treatment parameters. Five overlapping spots with the CO3 laser using a 5 mm spot at 6.1 J/cm2 with pulse durations of: 1) 500us, 2) 4ms, 3) 7ms, 4) 10ms. CO3 laser with a 5 mm spot and a 10 ms pulse duration and fluence of: 1) 0.9 J/cm2, 2) 2.4 J/cm2, 3) 5 J/cm2, 4) 7 J/cm2, 5) 7.7 J/cm2. The specimens were examined with an electron microscope for the depth of thermal coagulation and the depth of collagen contraction.

Results: When fluence was held constant, the mean depth of collagen coagulation and depth of collagen contraction was 26.7 um, 82.80 um at 500 us, 39.6 um, 117.15 um at 4 ms, 65.85 um, 99.12 um at 7 ms and 57.00 um, 34.5 um at 10 ms respectively. When fluence was varied, using a 10 ms pulse duration, the mean depth of thermal coagulation and depth of collagen contraction increased with increasing fluence.

Conclusion: This study demonstrated that when fluence is held constant the expected increase in thermal coagulation with increased pulse duration is followed up to 7 ms then a decrease occurs at 10 ms. The depth of collagen contraction increases from 500 us to 4 ms then decreases at higher pulse durations. When pulse duration is held constant, the expected increase in thermal coagulation with increased fluence was observed. The mean depth of collagen contraction increased as expected with the increased fluence. This suggests an effect of pulse duration limiting thermal coagulation and depth of collagen contraction beyond a threshold.

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EVALUATION OF A SILICONE OCCLUSIVE DRESSING AFTER LASER SKIN RESURFACING

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With the growing popularity of laser skin resurfacing, a number of closed dressings have appeared on the market which are thought to promote postoperative wound healing; however, few such dressings have been quantitatively evaluated. In patients who underwent combination CO_2/Erbium:YAG full face laser resurfacing, we undertook a comparison of postoperative progress in those treated with a dressing of silicone with a polytetrafluorethylene inner polymer network (Silon-TSR) and those treated with open wound care consisting of soaks and application of Aquaphor healing ointment. 35 patients who had the Silon dressing placed for three days postoperatively were selected randomly from a pool of patients treated over the past year and were retrospectively compared using t-tests with 35 randomly selected controls treated with open wound care. Erythema, crusting, pain, swelling, pruritus, purpura/bleeding, acne flare, and long-term complications were all evaluated. The two groups were similar in age, gender, skin type distribution, and treatment technique. In patients treated with Silon dressing, mean maximum erythema severity was 1.8 on a 0-3 scale as compared to a mean of 1.97 in those without the dressing ($p<0.05$). Erythema was noted for a mean of 17.3 days in the Silon group and 35.4 days in the open dressing group ($p<0.02$) while the mean time until total resolution of erythema was 49.5 days in the Silon group and 95.6 days in the open group ($p<0.005$). The Silon group experienced crusting limited to areas uncovered by the dressing such as the periorbital and perioral regions and the duration of crusting was 6.8 days as compared to 9.1 days in the open dressing group ($p=0.005$). There was a substantial decrease in severity of pain noted by clinicians caring for Silon patients, but this was not evident in the retrospective analysis. There was no significant difference in incidence or duration of swelling, pruritus, purpura, or acne flare between the Silon and open dressing groups. The most common postoperative complication in both groups was hyperpigmentation. These results suggest that application of an occlusive silicone polymer dressing decreases morbidity in the immediate postoperative period with a significant reduction in severity and duration of erythema and duration of crusting; however, long term results and complication rates remain unchanged.

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ABSTRACT TITLE: OPTIMIZING WOUND HEALING IN THE POST-LASER ABRASION FACE

Authors: Mitchel P. Goldman, M.D.; Greg Skover, Ph.D.; Thomas L. Roberts, III, M.D.; Richard E. Fitzpatrick, M.D.; John T. Lettieri, M.D.

STATEMENT OF PURPOSE: In an effort to optimize wound healing after laser resurfacing, a unique skin dressing system was developed.

METHODS OF STUDY: 42 patients received full-face LASER resurfacing at two clinics using either the UltraPulse CO2 laser alone, or followed by an Erbium:YAG laser and/or a blended CO2/Er:YAG laser (Derma-K laser) or a variable pulse Erbium:YAG laser (SCITON). 21 patients were randomly assigned to a postoperative regimen including SILON-TSR for the first three days followed by AQUAPHOR Ointment to complete the first two weeks and PURPOSE Moisturizer for the final two weeks. The other 21 patients received the NEUTROGENA MD RESURFACING RECOVERY SYSTEM following a specific regimen. The system includes FIBRACOL wound dressing followed by a hydrogel dressing, an ointment, a cream moisturizer, and a cleanser. Outcome variables included: exudate management, postoperative pain, POD dressings were no longer required, POD of complete epithelial regeneration and surface bacterial counts.

SUMMARY OF RESULTS: Ninety percent of subjects in both groups experienced either "no pain" or "minimal pain" during the first three days. Total bacterial counts were different at each site, peaking on day 3 and day 6 in the subjects managed with the RESURFACING RECOVERY SYSTEM and SILON-TSR/AQUAPHOR regimen, respectively. The average day subjects did not require a dressing was 3.0 days and 3.7 days in the group managed with the NEUTROGENA MD RESURFACING RECOVERY SYSTEM and SILON-TSR/AQUAPHOR, respectively. The average day of epithelial regeneration was significantly shorter at 6.3 days using the RESURFACING RECOVERY SYSTEM compared to 7.4 days for subjects using the SILON-TSR/AQUAPHOR regimen. There was no difference in infection, adverse sequelae, exudate management, or pain in either group.

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THE MICROSCOPIC EVALUATION OF NEO-COLLAGENESIS THREE YEARS AFTER CO_2 AND ERBIUM:YAG LASER RESURFACING

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Purpose: To evaluate the long term effects of Erbium:YAG and CO_2 laser resurfacing on new collagen synthesis

Methods: A 2 mm punch biopsy was done on the right and left peri-orbital area of a volunteer subject three years after Er:YAG and CO_2 laser resurfacing. The specimen were processed, stained with hematoxylin and eosin and evaluated microscopically

Results: A microscopic evaluation of both biopsy sites showed bands of new collagen

Conclusion: The persistent clinical improvement in facial wrinkles three years after Er:YAG and CO_2 laser resurfacing correlates well with the presence of new collagen. The zone of fibroplasia on either side suggests that both lasers can result in neo-collagenesis and that the underlying mechanism of wrinkle improvement is probably the same for both lasers.

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TREATMENT OF VERRUCOUS EPIDERMAL NEVI WITH ULTRAPULSE CO_2 LASER

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PURPOSE: To assess the efficacy of Ultrapulse CO_2 laser versus continuous wave CO_2 laser in the treatment of Verrucous Epidermal Nevi.

METHODS: Four patients (skin types IV-VI) with Verrucous Epidermal Nevi determined by both clinical and histological examination were enrolled in the study. One continuous plaque of nevus was divided into three equal parts. Top and bottom parts were randomized for either the Ultrapulse CO_2 laser or the continuous wave CO_2 laser with the middle part acting as the control. Follow ups were conducted at one, four, and twelve weeks to assess for recurrence and quality of healing.

RESULTS: No significant difference was observed at the two treated sites. Almost complete removal of the epidermal nevi was obtained without significant scarring of these patients at both of the treated sites. No evidence of recurrence was observed at three months.

CONCLUSION: Ultrapulse CO_2 laser and continuous wave CO_2 laser appear equally effective in the treatment of Verrucous Epidermal Nevi.

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SUCCESSFUL TREATMENT OF EPIDERMAL NEVI WITH ERBIUM:YAG LASER ABLATION: A CLINICAL AND HISTOLOGIC EVALUATION

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West Village Dermatologic Laser Surgery Center and
New York University Medical Center, New York, New York

PURPOSE: To demonstrate the efficacy of erbium:YAG laser ablation in the treatment of facial and non-facial epidermal nevi. Evaluations using both gross and microscopic parameters were utilized.
METHODS: Six patients with epidermal nevi (2 facial, 4 body) were treated with an erbium:YAG laser using multiple passes and fluences between 5 -10 J/cm^2. Patients received pre- and postoperative lesional photographs as well as skin biopsies. Evaluations were based upon overall cosmetic outcome, skin texture, pigmentation, patient satisfaction and histologic normalization. Subjects were followed for an average of 12 months, (range 6-24 months).
RESULTS: All subjects achieved at least a 75% improvement in the appearance and texture of the laser-treated nevi. Patient satisfaction ranged from 90-100%. All nevi flattened, skin texture became smooth, and the histologic findings correlated well with the clinical evaluations. No significant differences in facial versus non-facial lesional skin resulted except for faster healing times in facial regions. Treatment discomfort, transient hyperpigmentation, and crusting were the most common side-effects. Mild tissue fibrosis developed in 3 out of 6 subjects and persistent erythema lasted from 2-7 months. No hypertrophic scarring or infections were noted. There were no recurrences of nevi during the follow-up period.
CONCLUSIONS: Erbium:YAG laser ablation of facial and non-facial epidermal nevi is safe, effective, and has a high degree of patient satisfaction. Both clinical as well as microscopic normalization of skin results from this laser treatment.

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A COMPARISON STUDY OF COLD STEEL TITANIUM NITRIDE GRAFTS, ERBIUM AND COMBINED ERBIUM CO_2 HAIR TRANSPLANTATION (HTP)

Neil S. Sadick, New York Presbyterian Medical Center

Background: This study compares cold steel hair transplantation with Erbium and combined Erbium/CO_2 lasers. The CO_2 laser has been utilized for HTP; however, thermal damage of 10-100u has lead to prolonged crusting and thermal destruction of pilosebaceous units. The Erbium laser produces less lateral thermal damage (<10u), however, minimal hemostasis. The combined Erbium/CO_2 laser addresses these issues by producing hemostasis and minimal lateral thermal damage.
Materials and Methods: 10 patients were transplanted with the balding area split into 4 equal quadrants. 1 quadrant was transplanted with circular 1 mm cold steel minigrafts, 1 quadrant was transplanted with the Erbium CO_2 1.7 J/pulse 10 pps, 1 quadrant with K Blend Mode I Er:YAG 1.7 J/pulse 10 pps 5 W CO_2 50% duty cycle and the fourth quadrant with K Blend Mode II 10 pps Er:YAG 1.7J and 10 W CO_2 50% duty cycle. (8 pulses/1 mm spot size). Results were analyzed for hair counts (digital imaging), pilosebaceous destruction (lateral thermal damage) bleeding, crusting and graft compression as well as of graft handling time and ease of graft placement. (Paired T Test P< .005).
Results: An average of 548 grafts were transplanted in a single session yielding an average of 32.5 hairs/cm^2 Erbium, 34.0 hairs/cm^2 Erb CO_2 5 watts 25 hairs/cm^2 Erbium 10 watts CO_2 28.5 hair/cm^2 cold steel at 12 months (statistically significant). Crusting was slightly prolonged with the 1.7J Erbium 10 W CO_2 laser by 3 days. The aesthetic quality and side effect profiles were not different in the laser or cold steel quadrants. Collagen changes utilizing the 5W CO_2/1.7J Erbium hybrid laser revealed lateral thermal damage changes (<10u) similar to those noted with the Erbium laser alone.
Discussion: Combined CO_2/Erbium HTP produces tissue removal, minimal thermal damage to surrounding hair follicles, hemostasis, minimal crusting and hair growth comparable or superior to cold steel grafting.

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HISTOLOGIC EVALUATION POST NON-ABLATIVE RESURFACING WITH THE ER:YAG LASER IN COMBINATION WITH CRYOGEN SPRAY COOLING

Kristen M. Kelly, Boris Majaron, Wim Verkruysse, J.S. Nelson
Beckman Laser Institute and Medical Clinic;
University of California, Irvine

The purpose of this study was to determine the epidermal and dermal changes induced by multiple, low fluence (0.5-1.5 J/cm^2) Erbium: Yttrium Aluminum Garnet (Er:YAG) laser pulses in combination with cryogen spray cooling (CSC). Our goal was to achieve dermal collagen coagulation and subsequent remodeling without epidermal injury in an effort to offer a novel method of non-ablative laser skin resurfacing.
Multiple laser pulses, each with a fluence of 0.5-1.5 J/cm^2, were rapidly delivered to single spots on the back of Sprague-Dawley rats. Punch biopsies were performed 1 hour, 1 week, 4 weeks and 8 weeks following laser usage. Histologic sections were stained with H & E and evaluated for epidermal damage, collagen coagulation and dermal remodeling.
Histologic evaluation of specimens taken one hour post-laser revealed epidermal preservation with only minimal damage. Dermal coagulation necrosis was noted to a depth of greater than 100 μm In subsequent specimens, a hypercellular dermis with compact collagen was noted.
With the rapid delivery of multiple low fluence Er:YAG pulses, coagulation necrosis to a depth similar to that observed with traditional CO_2 resurfacing can be achieved. Furthermore, the addition of CSC allows epidermal preservation. This method offers a novel approach to non-ablative laser skin resurfacing and may allow rhytid improvement while minimizing risks associated with traditional laser skin resurfacing including infection, skin dyspigmentation and scarring.

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NON-ABLATIVE SKIN REJUVENATION USING INTENSE PULSED LIGHT

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The purpose of this study was to evaluate the degree of improvement in photoaging following serial, full-face intense pulsed light (IPL) treatments.
Thirty patients underwent five full-face treatments at three week intervals using a non-coherent broad-band visible light source (PhotoDerm™VL/PL, ESC Medical, Inc., Needham,MA). Results were determined by patient assessment of post-treatment changes and physician assessment of pre- and post-treatment photographs. The IPL parameters used were a 550nm cut-off filter, double pulses with pulse durations of 2.4-4.0 msec and fluences of 30-36 J/cm2.
Forty-nine percent of patients reported a 75% or greater overall improvement in the appearance of their skin. A 75% or greater degree of improvement was seen in facial erythema (57% of patients) and telangiectasias (49% of patients). Seventy-three percent of patients reported a 25% or greater degree improvement in fine wrinkles, while 36% of patients reported a 50% or greater improvement in fine wrinkles. Seventy-six percent of patients reported a 50% or greater improvement in skin smoothness and 79% of patients reported a 50% or greater improvement in pore size. Physician assessment of pre- and post- treatment photographs was done in a blinded fashion. Improvement in skin texture, fine wrinkles, irregular pigmentation, pore size and telangiectasias was observed in all patients. Adverse effects of purpura or swelling resulting in patient downtime of one to three days occurred in less than two percent of patients. No scarring was reported in 150 total treatments.

This study demonstrates the beneficial effects of serial full-face IPL treatments in the amelioration of photoaging. Using the technique and parameters employed by the investigators in this study there was minimal patient downtime and discomfort and no scarring. Serial full-face IPL treatments are an alternative for patients who are not candidates for laser skin resurfacing (LSR) or who desire to avoid the discomfort and downtime of LSR.

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EFFECT OF PULSE DYE LASER AND INTENSE PULSED LIGHT SOURCE ON THE DERMAL EXTRACELLULAR MATRIX REMODELING. Brian Zelickson and David Kist. University of Minnesota Department of Dermatology, Minneapolis, MN.

Purpose: The purpose of this study was to evaluate the effects of the pulsed dye laser (PDL) and intense pulsed light source (IPL) on the production of procollagen, collagen type I and III, collagenase, elastin and hyaluronate receptor in sun damaged skin.

Methods: Nine patients with sun damage were given informed consent for biopsy and laser treatment. Pretreatment periorbital biopsies were taken and fixed in formalin. Seven patients then underwent subsurface resurfacing with the PDL and two patients were treated with the IPL. Biopsies were taken at regular intervals after treatment up to six weeks. The biopsies were embeded in parafin, sectioned at 4 um, and stained with antibodies for procollagen, collagen type I and III, collagenase, elastin and hyaluronate receptor. The slides were analyzed by light microscopy.

Results: Collagen type I and III and elastin showed increased levels of protein in the papillary dermis after PDL laser treatment in 85.7% of specimens and after IPL in 100% of specimens. Collagenase was increased in 85.7% with the PDL and 50% with the IPL. Procollagen was increased in 71.4% with the PDL and 100% treated with the IPL. Hyaluronate receptor was increased in 57.1% treated with PDL and 100% treated with IPL. Of particular interest was the localized increased expression of some proteins near neurovascular bundles and single fibroblasts.

Conclusion: Subsurface resurfacing is a less traumatic effective treatment for low grade wrinkles. This method achieves it results by stimulating the production of extracellular matrix proteins and enzymes by dermal fibroblasts.

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A COMPARISON BETWEEN THE SUBSURFACE REMODELING EFFICACY OF AN INTENSE PULSED LIGHT SOURCE AND A MILLISECOND 1064nm Nd:YAG LASER. David J. Goldberg, New Jersey Medical School and Skin Laser Center, Pascack Valley Hospital, Westwood, New Jersey.

The purpose of this study was to compare the subsurface remodeling efficacy of a non-laser intense pulsed light (IPL) source and a 1064nm Nd:YAG laser. Ten subjects were each treated with 3 sets of parameters. One region was treated with an IPL using a 590nm filter; one region was treated with an IPL using a 755nm filter; one region was treated with a millisecond 1064 Nd:YAG laser. Subjects received up to five treatments. All subjects were evaluated for degree of clinical improvement and adverse events. Most subjects showed some improvement with a variety of utilized parameters. Both an IPL and a millisecond laser can be used successfully for subsurface remodeling. The degree of improvement is not what would be expected in an ablative laser system.

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Non-Ablative Laser Therapy in Skin Types I – VI: Clinical Evaluation of Facial Treatment using QS 1064nm Nd:YAG Laser Combined with Carbon Suspension Lotion . John Newman MD[2], Jeff Lord MD[2] ,David H. McDaniel MD[2,3].

From the Laser Center of Virginia[1], Virginia Beach, Virginia. The Dept of General Surgery[2], Naval Medical Center, Portsmouth, Virginia. Eastern Virginia Medical School[3], Norfolk, Virginia.

Purpose: To validate the clinical safety and efficacy of the process of QS 1064nm Nd:YAG laser combined with carbon suspension topical lotion (SoftLight Peel TM) in all skin types.

Methods: Total of 12 patients were chosen (2 from each Fitzpatrick skin type) and all were treated with 1064nm QS Nd:YAG laser using 6.7mm spot, 2.5J/cm2, 10HZ. 3 passes at 10% overlap. Prior to laser the skin was treated with a proprietary carbon lotion . Post treatment another glycolic acid based lotion was applied daily. Test spots were performed post auricularly on all type IV-VI patients and observed for 4-6 weeks prior to treatment. A total of 4 laser treatments were performed and 7-10 day intervals. Serial photographs and patient diaries were used to monitor results.

Results: Purpura, blistering, crusting were not observed and redness and mild stinging were reported by some patients lasting a day or less for types I-III. However, skin types IV-VI reported an average of 0.5 to 1.5 days of each of these effects. Transient folliculitis was common. Blinded grading of rhytid and dyschromia improvement showed similar effects for rhytids (average of 25%) for both groups, but about 20% versus 35% pigment improvement for groups I-III and IV-VI respectively. Additional data is available for skin moisture, chromometer, and silicone profilometry results and will be reported. One patient with pseudofolliculitis barbae showed dramatic improvement of this disorder. Two type VI patients experienced small focal transient areas of hypopigmentation near the end of the treatment series and treatment fluence was reduced in these cases.

Conclusions: This treatment process was overall well tolerated and safe. The darkest skin types experienced more discomfort and more transient adverse effects, while the lighter types had almost none. Rhytid improvement was the dominant clinical effect for types I-III while pigment improvement was more prominent in types IV-VI. The aftercare lotion which was intended to minimize the folliculitis produced by the oil vehicle used for the carbon lotion may also have contributed to some of the observed clinical improvements. Individualization of treatment parameters is advisable to minimize discomfort and possible hypopigmentation for skin types V and VI.

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Painless Non-Ablative Treatment of Photoaging with the 1320nm Nd-YAG Laser.

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Purpose: To determine if thermal injury is essential for laser-induced cosmetic improvement

Methods: A group of 24 volunteers with varying degrees of photodamage were treated with the 1320nm Nd: YAG laser at fluences below the threshold of pain, so that thermal injury would not occur. An average of 28 treatments, in a twice a week schedule, for three consecutive months were given to each patient. Biopsies from pre-auricular skin were obtained in 5 subjects, pre-treatment and 6 months after the last treatment session.

Results: All changes were mild to very mild when compared with traditional laser resurfacing, however, an increase in skin turgor was evident in 17 patients while wrinkle improvement was noted in 14. Skin clarity and glow improved in 19 of 24 patients. Histologic changes were observed in all 5 patients collagen appeared more eosinophilic and homogeneous, there was a diminution of the interstitial spaces between fibers. Dermal thickness and density appeared increased. Each treatment lasted less than 2 minutes. Patient acceptance of treatments was as expected in view of complete absence of pain, no need for anesthesia, no erythema or edema and no morbidity.

Conclusions: Although the changes were mild, the mechanism by which this laser produced cosmetic improvement may be remains to be determined.

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Non-ablative skin remodeling using a 1.54μm laser with contact cooling.

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Selective dermal remodeling using diode or 1.32μm Nd:YAG lasers has been recently proposed for skin rejuvenation. This new technique consists in inducing collagen tightening and/or neocollagen synthesis without significant damage of the overlying epidermis. Such an approach requires i)a cooling system in order to target dermal collagen with relatively good protection of the epidermal layer, ii)a specific wavelength for confining the thermal damage into the upper dermis (100 to 400μm). This experimental study aimed to evaluate a new laser (Aramis, Quantel-France) emitting at 1.54μm. Epidermis cooling was achieved using the Dermacool system (Dermacool, Mableton, USA). Male hairless rats were used for the study. Different fluences (26 to 30 J/cm^2) using single 3ms pulse irradiation or pulse train irradiation (8J, 2Hz, 4 to 20 pulses) and different cooling temperatures (+5°C, 0°C, -5°C) were screened with clinical examination and histological evaluation at 1, 3, and 7 days after laser irradiation. The clinical effects were clearly dose and temperature cooling dependant. Varying degrees of erythema and edema were noted. However, it appeared that single pulse irradiation led to epidermal whitening in most cases, whatever the cooling temperature. Conversely, pulse train irradiation showed reproducible epidermal preservation and confinement of the thermal damage into the dermis. New collagen synthesis was confirmed by a marked fibroblastic proliferation, detected in the lower dermis at D3 and clearly seen in the upper dermis at D7. The clinical evaluation on humans performed with similar setting (contact cooling and 1.54μm laser emitting a pulse train) has confirmed these experimental results. This new laser appears to be a promising new tool for the treatment of skin laxity, solar elastosis, facial rhytids and mild reduction of wrinkles.

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LASER SAFETY FEATURES OF EXTERNAL LASER SHIELDS

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Purpose: A number of lasers are available for cutaneous surgery, yet not all eye shields are appropriate for all applications. We tested several commercially available external eye shields to assess their safety features.

Methods: Several commercially available eye protectors were studied with 6 different lasers. A focused laser was incident upon the shield, and the intensity and exposure duration required for visible damage to the shield were measured. We then measured the temperature on the underside of the eye shield during exposure from the laser. Time-dependant temperature measurements were made with a type T thermocouple fixed to the eye shield with silicon grease. The probes were interfaced to a data acquisition system (OMB-Tembook-66) attached directly to a desktop PC's parallel port. The temperature was recorded at 248 readings/sec. for a total of 2500 scans and then analysed via 2 different softwares. Tempview for graphical data-logging application and post view for post-acquisition graphical wave form display application.

Results: Thermal response curves and rates of warming for every external eye shields were generated. Plastic eye shields showed significant thermal damage with most laser tested. The metallic (stainless steel) shields warmed more slowly and to a lesser degree.

Conclusion: Overall, the metallic eye shields had the most acceptable safety profile. The plastic shields exhibited significant thermal damage, and therefore we discourage their use especially in periorbital laser surgery.

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Abstract

308 NM EXCIMER LASER FOR THE TREATMENT OF PSORIASIS.

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Since narrowband UVB phototherapy at 311 nm has emerged as a successful therapy for the treatment of psoriasis, we decided to investigate the efficacy and safety of excimer laser radiation at 308 nm, a neighboring wavelength, in the treatment of this chronic skin condition. We recruited a maximum of 25 patients with stable plaque psoriasis. Each patient was assessed via the Psoriasis Area and Severity Index (PASI) scores. A minimum of 2 symmetrical plaques, each at least 2 square inches in area, was targeted for study in each subject. One plaque served as a control. With the excimer laser, minimal erythema doses (MED's) were performed on uninvolved, sun-protected skin with doses ranging from 50 to 1200 mJ/cm^2. Final MED determinations were at 24 hours. Treated plaques received up to 16 MED multiples. Using a clear plastic template, each treated plaque was carefully mapped out. Clinical evaluations and photographic documentation were obtained at baseline and at each follow-up visit, namely 1 week, 2 weeks, 1, 2, 4, and 6 months.

Results: Treated sites showed a range of localized, mildly uncomfortable sunburn reactions with some blistering at the highest doses by 24 hours. Clearing of some of the plaques occurred within just a few weeks. Even at 6 months, some treated sites remained free of psoriasis. Occasionally, post-inflammatory hyperpigmentation was noted, but there was no scarring.

Conclusion: The 308 nm excimer laser presents an exciting new user-friendly, approach for the treatment of localized, recalcitrant plaque psoriasis.

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Topical ALA-photodynamic therapy of acne vulgaris

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Propionibacterium acnes bacteria, and human sebaceous glands, both convert ALA into the photosensitizer, protoporphyrin. Topical ALA-photodynamic therapy(PDT) might therefore improve acne, by sterilizing sebaceous follicles, reducing sebum secretion, or both. ALA-PDT was studied to detemine the safety and efficacy for the treatment of acne vulgaris

Each of 22 subjects with acne vulgaris on the back was treated in 4 sites with ALA plus red light (ALA-PDT), ALA alone, light alone, and untreated control. Half of the subjects were treated once; half were treated 4 times. 20% topical ALA was applied with 3hr occlusion, and 150J/cm^2 broad band light (550-700nm) was given. We measured sebum excretion rate and natural porphyrin fluorescence from the bacteria before, and at 2, 3, 10, and 20 weeks after treatment. Biopsies from PDT and ALA alone areas were used to determine histologic change and *PpIX* synthesis in pilosebaceous units.
An acne-like eruption occurred within 1 week after both single and multiple PDT treatments, which cleared rapidly. Sebum secretion was eliminated for several weeks, and decreased for 20 weeks after PDT; multiple treatments caused greater sebum output suppression. Bacterial porphyrin fluorescence was also suppressed by PDT. On histology, sebaceous glands showed acute damage and were smaller, after PDT 20 weeks. Clinically, there was significant clearance of inflammatory acne ($P<0.05$) by PDT compared to control areas up to 20 weeks after multiple treatments and up to 10 weeks after single treatment. Transient hyperpigmentation, epidermal exfoliation and crusting were observed.
Topical ALA photodynamic therapy is an effective treatment of acne vulgaris, associated with significant side effects. With optimization, ALA-PDT may be clinically practical for some patients with acne.

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LOW INTENSITY LASER THERAPY IS AN EFFECTIVE TREATMENT FOR RECURRENT HERPES SIMPLEX INFECTION - RESULTS FROM A RANDOMIZED DOUBLE-BLIND PLACEBO-CONTROLLED STUDY

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Recurrent infection with herpes simplex virus is a frequent disease. Low intensity laser therapy mainly used for the acceleration of wound healing and in pain therapy has previously been shown to be of benefit in herpes zoster infections. In the present study we evaluated the influence of low intensity laser therapy (wavelength 690nm, intensity: 80mW/cm^2, dose: 48J/cm^2) in 50 patients with recurrent perioral herpes simplex infection (at least once per month for more than 6 months) in a randomized, double-blind placebo-controlled trial design. Patients in the laser-group received daily irradiations for two weeks, whereas patients in the placebo group were sham-irradiated. After completion of the laser/sham-treatment, patients were told to present at the Department at the time of recurrence. All patients except for two completed the study and were monitored for 52 weeks. The median recurrence-free interval in the laser-treated group was 37.5 weeks (range: 2-52 weeks) and in the placebo group 3 weeks range: 1-20 weeks). This difference was found to be statistically significant ($p < 0.0001$; Wilcoxon's Rank Sum Test). In conclusion, we demonstrate that a total of 10 irradiations with low intensity laser therapy significantly lowers the incidence of local recurrence of herpes simplex infection. Since this athermic phototherapeutic modality represents a safe, non-invasive treatment, it might be considered as an alternative to established therapeutic regimens in this indication.

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COMPARATIVE STUDY OF THREE TOPICAL ANESTHETICS AFTER 30-MINUTE APPLICATION TIME

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There are now several topical anesthetics that are being used prior to laser and surgical procedures. We previously reported a controlled, prospective study comparing the efficacy of several new topical anesthetic agents after a 60-minute application time. In order to compare the degree and duration of anesthesia produced after a shorter application period, we performed a prospective study, investigating the efficacy of EMLA (Astra USA, Westborough, MA), ELA-Max5 (Ferndale Laboratories Inc., Ferndale, MI), and Topicaine (EBSA Laboratories Inc., Mountain View, CA) using a 30-minute application time.
Equal amounts of the above topical anesthetics plus a control were randomly applied to eight test sites under occlusion on the volar forearms of eight adult volunteers. After a 30-minute application time, the degree of anesthesia was assessed immediately by a Q-switched Nd-YAG laser (Continuum Biomedical, Livermore, CA) emitting energy at 1,064nm. The degree of anesthesia was then tested at 15 and 30 minutes after removal of the anesthetics. Volunteer responses to pain stimuli were recorded using an ordinal scale from zero (no pain) to four (maximal pain). The mean scores for the time intervals were obtained. Analysis of the data was performed using ANOVA, Newman-Keuls test, Friedman-rank order test, and paired t-tests.
All of the topical anesthetics used in this study appeared safe and effective, varying in onset, duration, and depth of anesthesia. The lower pain scores correlated with the greater degree of anesthesia.
The ideal topical anesthetic should provide full anesthesia after a short application period. Using a 30-minute application time, there was a clinical increase in efficacy suggested with all of the anesthetic agents over control 15 and 30 minutes after their removal.

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HAIR REMOVAL BY A PULSED, RUBY LASER SYSTEM (E2000) WITH A TWIN-PULSE MODE AND PHOTON RECYCLING

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The purpose of this study was to evaluate the efficacy and safety of a 694 nm, pulsed ruby laser for hair removal (E2000, Palomar Medical Technologies, Lexington, MA). The source can produce fluences up to 50 J/cm^2 and variable pulse widths of 3 or 100 msec (twin pulse mode). Pulses are delivered through an optical handpiece which provides a hexagonal output aperture of 10 mm, a square output aperture of 20 mm with photon recycling, refractive index matching, and contact-cooling of the skin surface. The photon recycling will recycle most of the reflected/scattered light by reflecting it back to the skin and as a result, photon recycling maximizes the efficiency in delivering energy to hair follicles.
Twelve subjects were treated at 17 test sites, with a range of fluences using the EpiLaser (10 mm spot size) and the E2000 (10 mm hexagonal and 15 & 20 mm square spot sizes). There was also a shaved, unexposed control site. All test sites received a single treatment. Hair counts were obtained prior to treatment and at 1,3,6,9 and 12 months post laser treatment using digital images obtained with a CCD camera. Additionally all patients also received up to 3 treatments of elective sites.
There was a significant hair growth delay in all subjects. There was also apparently permanent hair loss at long-term follow-up: a single treatment with the E2000 induced an average long term hair reduction of 47%. The efficacy of the EpiLaser at 30J/cm^2 with a 10 mm spot size was similar to the efficacy of the E2000 at 8J/cm^2 with the 20 mm adapter. Transient pigment changes were seen. Conclusions based on these preliminary data suggest that the pulsed, 694 nm ruby laser is a safe and long lasting method for hair removal.

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EFFICACY AND SAFETY OF LONG-PULSED ALEXANDRITE LASER WITH DYNAMIC COOLING DEVICE (DCD)™ FOR HAIR REMOVAL IN SKIN TYPES II-V

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Laser-assisted hair removal in patients with dark-colored skin has been always regarded as a risky procedure due to increased incidence of side effects. The aim of this study was to evaluate the efficacy and safety of 3 msec long-pulsed alexandrite laser (755 nm) used in conjunction with Dynamic Cooling Device (DCD)™ in patients with skin types IV & V.

A total of 341 sessions were done to 125 patients (22 skin type II, 38 type III, 42 type IV, and 23 type V). All patients had black or dark brown hair. A variety of body areas have been treated with fluence 20-25 J/cm2, 12 mm spot size, 50-60 msec DCD spray duration, and 3 msec DCD delay time. A total of 16 skin biopsies were obtained from treated areas immediately following laser treatment, 4 months after last laser session, and from post-laser hypo- and hyperpigmented lesions.

All subjects showed significant changes in hair characters (thinner, lighter and slower growth rate). In 105 patients who completed 3 sessions at 1-3 month interval, the mean percentage of hair reduction 4 months after the last treatment was 58.53, 54.83, 54.46, and 48.75% in skin types II, III, IV, and V respectively. Statistically significant difference in efficacy existed between skin types II and V only. The overall incidence of side effects were 8.92, 7.84, 10.8%, 11.11% in skin types II, III, IV, and V respectively (statistically non-significant). Side effects were temporary in most cases. Histological studies confirmed the damage to hair follicles. Hypopigmented lesions showed a characteristic block of melanin transfer from melanocytes to keratinocytes.

With the laser parameters used in this study, 3 msec alexandrite laser used with DCD seems to offer a relatively effective and safe method for hair removal in skin types IV& V. However, more sessions might be needed to obtain high percentage of hair reduction in dark-colored subjects. Individual susceptibility might be responsible, at least partly, for the occurrence of side effects.

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LONG-TERM CLINICAL AND HISTOLOGIC EVALUATION OF LASER-ASSISTED HAIR REMOVAL : COMPARISON OF LONG-PULSE DIODE AND LONG-PULSE ALEXANDRITE LASERS

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Purpose: To compare clinical and histologic efficacy, side effect profile, and long-term hair reduction of a long-pulse diode and a long-pulse alexandrite system.

Methods: Twenty females with Fitzpatrick skin phototypes I-IV underwent 3 monthly sessions of axillary laser-assisted hair removal with a long-pulse alexandrite laser (755 nm, 2 ms pulsewidth) and a long-pulse diode laser (800 nm, 12 – 20 ms pulsewidth). Areas were randomly and blindly selected to receive treatment using the 2 different systems at either 25 J/cm^2 or 40 J/cm^2. Patients returned for follow-up at 1, 3, and 6 months after the final treatment session. During each treatment and follow-up visit, manual hair counts and photographs were obtained per treatment area. Histologic specimens were obtained at baseline, immediately after the initial laser treatment, and at 1 and 6 months postoperatively.

Results: After each successive laser treatment, a reduction in hair counts was seen and patients reported decreased need to shave. The best clinical response was seen one month after the second laser treatment in all areas, regardless of the laser system or fluence used (average 60 – 75% hair reduction). Six months following the third and final treatment, there continued to be prolonged clinical hair reduction without significant differences seen between laser systems and fluences. Histologic tissue changes mirrored clinical response rates with evidence of initial follicular injury followed by regeneration of some follicles over the ensuing months. Side effects, including treatment pain and vesiculation, were observed more often with the long-pulse diode system at 40 J/cm^2.

Conclusions: Equivalent clinical and histologic responses were observed using a long-pulse alexandrite and a long-pulse diode laser for hair removal with minimal adverse sequelae. While long-term hair reduction can be obtained in most patients after a series of laser treatments, partial hair regrowth is typical within 6 months, suggesting the need for maintenance laser therapy.

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HAIR REDUCTION USING THE NIDEK 800 NM DIODE LASER

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The purpose of this study was to demonstrate hair reduction using the Nidek 800 nm diode laser. This laser is based upon the latest diode laser technology rather than solid state (e.g. alexandrite) laser technology. Unlike the alexandrite or ruby lasers, the Nidek diode laser can deliver energy over a time duration that more closely approximates the predicted thermal relaxation time of the hair follicle. Therefore, this laser is able to achieve the required energy exposure over a time period that targets the hair follicle for selective destruction, yet with relative epidermal sparing. Over 30 volunteers with Fitzpatrick skin types ranging from I-V and hair color varying from light brown to black, have been treated. Treatment sites were standardized for all patients. A range of fluences were used, with ~50 J/cm^2 being the highest fluence delivered. Baseline hair counts were obtained before treatments, and post-treatment hair counts were assessed at 30, 60, and 90 days from the last treatment. Biopsies were also taken from control and treatment sites. Clinical side effects were measured immediately post treatments and at each follow-up visit. Post-treatment side effects included mild transient pruritus, post-inflammatory hyperpigmentation, epidermal scaling, and/or blistering in a small percentage of patients. After one treatment, preliminary data reveals an average of ~30% reduction in hair counts after 90 days for patients treated with 50 J/cm^2. Lower light doses were less effective in reducing hair counts. Percentage reductions as high as 70% were obtained in patients with thick, dark hair. This laser was found to be much less effective for patients with thin, light-brown hair. Histologic examination reveals selective destruction of pigmented hairs with minimal thermal damage to surrounding tissues and relative epidermal sparing. In sum, permanent hair reduction using the Nidex 800 nm diode laser requires appropriate patient selection to increase efficacy and minimize side effects. The most important patient determinants predicting success were hair color and thickness.

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COMPARISON OF TWO INFRARED LASER SYSTEMS FOR HAIR REMOVAL

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Objective: To assess and compare the efficacy of hair removal by high energy diode laser treatment at 808 and 983 nm.

This is a prospective study with each subject serving as his/her own control. Informed consent is obtained from all subjects after objectives, design and risks of the study are explained. Patient pretreatment evaluations includes medical evaluation, review of enrollment criteria, and determination of skin type (Fitzpatrick scale I-VI).

Methods: Large test sites on the back or thighs of N=17 consecutive patients with skin type I-V (fair to dark-skinned) and any hair color, are shaved and treated with 15-25 joules / cm2 fluence (15,20,25), 10 X 10 mm spot size (square), using two

different diode lasers: 808 nm and 983 nm. Baseline and subsequent regrowing terminal hair caracteristics are obtained from each site by digital imaging and sophisticated software analysis for hair count and hair diameter and analysis for hair color. One adjacent control (shaved) site is also analysed. Test sites are on the back or posterior aspect of the thighs based on uniformity, density and hair growth cycle (5-8 months) of terminal hairs. Twenty-seven 2 X 3-cm areas are mapped and photographed. Hair caracteristics are obtained monthly for 12 months. Before laser exposure every test sites are shaved. Half of the sites are irradiated with a 808 nm diode laser and the other half with a 983 nm diode laser with one shaved control site. Laser pulses are given in a contiguous, nominally nonoverlapping pattern that covers the entire test site.
Results: For both wavelenghts (808 & 983nm), all subjects were responders and regrowing hairs were thinner and lighter. However the response (maintained at 8 months) was significantly higher at 808 nm with 33 % hair loss after 1 treatment, 52 % hair loss after 2 treatments, 75 % hair loss after 3 treatments and >75% hair loss after 4 treatments. Transient pigmentary changes were observed. There were no incidents of scarring.
Conclusions: These results show that diode lasers can affect either structural recovery (size of hair) and follicular pigmentation (hair absorption coefficient) even with low fluence energy (up to 25 J/cm2). The response is wavelenght-dependent with a cumulative effect after multiple treatments.

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HIGH ENERGY PULSED 810 NM DIODE AND LONG PULSED 1064 NM ND:YAG LASERS IN THE LASER-ASSISTED HAIR REMOVAL. A CLINICAL AND HISTOLOGIC COMPARATIVE STUDY

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We compared a new high energy 810 nm Diode laser and a long pulsed Nd:YAG laser in laser-assisted hair removal. Twenty patients with pigmented hair were treated in a bilateral fashion. Diode sites received 40-60 J/cm2 and Nd:YAG sites were treated at 50-80 J/cm2. In addition, histologic specimens were studied in order to observe similarities and differences of tissue effects. Histologic effects appeared similar with evidence of extensive damage to the hair bulb from both lasers. In addition, Factor 8 stains showed evidence of microvascular injury in the peribulbar tissue suggesting the possibility that vascular damage may play a role in the process of laser hair removal. Preliminary clinical results show that both lasers were effective with less discomfort and somewhat greater efficiency noted at Diode-treated sites.

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LASER HAIR REMOVAL WITH THE LONG-PULSE 1064 nm COOLGLIDE LASER SYSTEM

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The trend in long-pulse hair removal laser systems has been towards longer wavelengths, taking advantage of the deeper light penetration and the ability to treat darker skin types. The purpose of this study is to determine the safety and efficacy of a long-pulse high-power Nd:YAG laser (1064 nm) for the removal of unwanted pigmented hair. 25 subjects with Fitzpatrick skin types I-V were enrolled in a prospective, controlled clinical study. Each subject received treatment on two body areas selected from the face, arms, legs, axilla, bikini line and back. One control site and 2 treatment sites were identified on each body area selected, resulting in a total of 100 treatment sites and 50 control sites. All sites were shaved and treatments were performed using fluences of 50 J/cm^2 or 60 J/cm^2, pulse widths of 15 ms or 30 ms, a laser spot size of 1 cm^2, and epidermal contact cooling. Epidermal response was assessed and high resolution digital photographs were taken pre-operatively and at 1 day, 1 month, 3 months and 6 months after the treatment, with half of the sites receiving a repeat (second) treatment at 3 months. Hair counts were performed by a blinded, independent observer using highly magnified prints of the digital photographs. Combining the results of all treatments performed at the maximum fluence for each pulse width, the median hair count reduction was 27% at both 3 months (N=68) and 6 months (N=34) after 1 treatment, and 50% (N=32) at 3 months after 2 treatments. At the 1 month and 3 month follow-up visits, the only observation was rare mild hyperpigmentation, all of which cleared by 6 months. Twelve month data and treatments at higher fluences will be presented. This study demonstrates that the CoolGlide (Altus Medical) long pulse Nd:YAG Laser system is safe and effective for the removal of unwanted hair in patients with Fitzpatrick skin types I-V.

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VERY LONG-PULSED (20-200 ms) DIODE LASER FOR HAIR REMOVAL ON ALL SKIN TYPES

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Purpose: To evaluate the efficacy and safety of very long 800 nm diode laser pulses for hair removal on all skin types (I-VI).
Methods: 40 adult subjects, representing all "Fitzpatrick skin types" (16-VI, 5-V, 5-IV, 5-III, 5-II, 4-I) were treated in the study. 24 test sites per subject, were marked and hair counts obtained using digital images from a CCD camera. Test sites were treated with the diode laser system (modified LightSheer, developed by Palomar Medical Technologies, Inc and Star Medical Technologies, Inc.) with combinations of very long pulsewidths (20-200 ms) and fluence levels (15-100 J/cm^2). The diode laser utilizes contact cooling (ChillTip™) to improve epidermal protection. Hair regrowth, hair shaft diameter and associated epidermal side effects were assessed at 1,2,3, and 6 months post laser treatment.
Results: Preliminary results from the diode laser demonstrate that very long pulsewidth does not significantly decrease the efficacy for hair removal for any given fluence. Long term hair loss was strongly correlated with fluence, regardless of pulsewidth. Additionally, very long pulse-widths allow for all skin types to tolerate substantially higher fluences, allowing for darker skin types to safely and effectively be treated. Transient pigment changes were the most common side effect, which is significantly reduced with longer pulsewidths. Textural changes occurred more often with high fluences, dark skin, and/or short pulsewidths. Textural changes did not occur without apparent acute epidermal damage.
Conclusions: An 800 nm diode laser with surface cooling and very long pulsewidths, appear to allow for effective, long-term hair removal of pigmented hair, even in dark skin. Caution should be used when using very long pulsewidths to treat dense haired areas, because of thermal conduction between closely adjacent hair follicles.

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EFFECTS OF VERY LONG LASER PULSES (30-1000 ms) ON HUMAN HAIR FOLLICLES

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PURPOSE: To investigate the effects of pulse duration in the range of 30-1000 ms on the thermal damage pattern of human hair follicles and perifollicular tissue after 810 nm diode laser irradiation.

METHODS: Ex vivo human scalp samples with dark hair were irradiated with 810 nm diode laser pulses. The fluence ranged from 10-180 J/cm^2 with varying pulse duration (30, 200-1000 ms). The samples were processed for serial transverse cryosections. Thermal damage was evaluated by nitroblue tetrazolium chloride (NBTC) viability stain. Hair follicle stem cells were localized immunohistochemically by C8/144B monoclonal antibody that recognizes cytokeratin 15 (stem cell marker).

RESULTS: Thermal damage pattern at the level of the bulge was similar for pulse durations between 30 to about 400 ms for a constant fluence of 40 J/cm^2. Selective damage of the hair follicle and loss of viability stain in the location of the stem cells was observed in about 30% of all hair follicles. Damaged hair follicles were located next to unaltered hair follicles. Thermal damage varied within different levels of the tissue. For a fluence of 40 J/cm^2 and pulse durations longer than about 400 ms the thermal damage of the stem cells decreased. Sebaceous glands adjacent to pigmented hairs were affected, with loss of viability. Hair shaft morphology was grossly altered with short (30 ms) pulses. Pronounced non selective damage occurred only with very long pulse duration at high fluences. The threshold for such non selective damage apparently decreased with increased hair density.

CONCLUSIONS: The histologic findings demonstrate that effective hair removal with 810 nm laser should be possible with pulse durations substantially longer than 30 ms. The combination of very long pulse duration with high fluence is associated with a risk of non selective tissue damage.

This study was supported by Palomar Medical Technologies, Inc.

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A LONG TERM FOLLOW UP OF HAIR REMOVAL WITH A SECOND GENERATION OF BROAD SPECTRUM INTENSE PULSED LIGHT SOURCE

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Although long-term hair removal has been demonstrated using lasers and non-coherent light sources, permanent hair removal has been difficult to claim due to the long growth/rest cycle of human hair follicles. The purpose of this study was to evaluate hair removal of bikini lines with a new second generation of intense pulsed light source(IPL). This system is only available in Europe.10 females with 20 bikini lines with dark hair and skin type II-IV, were treated with a IPL (600 nm) 4 times with 1 month interval. Counting the hair follicle were performed with a computer imaging system before treatment, 4 and 8 months after the treatments.
Hair reduction of 74.7 (S.D.±18.3) % were seen 4 months after the treatments and 80.2 (S.D.±20.3) % 8 months after the laser treatment. Only minimal side effects were noted and no pain or other discomfort was registered during the treatments.
Standardization of treatment parameters for long-term or permanent hair removal and comparative trials of different hair removal methods are needed. The ideal post treatment period should include the time of 1 complete hair cycle for that body area plus and additional 6-month 'recovery' time.
This new IPL system is both efficient and safe for hair removal. Since the follow up period of 8 months is twice the cycle time for hair in the bikini area, the obtained hair reduction in this study may be close to permanent, we "dare" to use this term).

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A TWO YEAR FOLLOW-UP OF HAIR REMOVAL UTILIZING THE BROAD-SPECTRUM FLASHLAMP

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Background: Previous clinical and histologic studies have shown that broad-spectrum flashlamp photoepilation (500nm – 1200 nm) is an efficient modality for removing unwanted body hair. The pesent study documents the long-term 2-year efficiency of this therapeutic modality.
Materials and Methods: 37 patients (30 female 7 male) mean age 34 were treated with a mean of 2.6 treatment sessions at monthly intervals utilizing a broad spectrum flashlamp device. End point of therapy was either clinical satisfaction or a maximum of 6 treatment sessions (Skin Types II-V were treated). Anatomic zones – chest (6), abdomen (4), back (3), bikini (10), chin (6), and lip (8).
Parameters: Skin type 2, 615 filter, 39-42J, Double pulse, Delay 30 msec; Skin type 3, 645 filter, 36-36J, Double pulse, Delay 30 msec; Skin type 4, 645 filter; 34-40J, Triple pulse, Delay 40 msec; Skin type 5, 695 filter, 38-40J, Triple pulse, Delay 40 msec. Patients were subsequently followed at 3-month intervals with hair counts performed by digital phototrichogram counts. Data was analyzed by the Kruskal-Wallis Test ($P<05$).
Results: A mean hair removal efficiency of 78.8% at 24 months was achieved after an average of 2.6 treatment sessions. The lip, chin and bikini areas showed the best responses.
Side Effect Profiles: Persistent erythema was noted in 8% of patients, temporary hyperpigmentation 11%, crusting 2%.
Discussion: The broad spectrum flashlamp produces efficient photoepilation for multiple phenotypes in various anatomic locations. Persistent epilatory clearing for greater than 3 hair cycles suggest long-term clinical efficacy

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LONG TERM COMPARISON OF DIFFERENT LASERS AND LIGHT SOURCES FOR HAIR REMOVAL

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Purpose: To evaluate and compare a flashlamp pulsed light source (590-1200 nm, 2.5-5 ms, 30-65 J/cm^2), two long pulsed ruby lasers (694 nm, 3 ms, 10-40 J/cm^2, 7-10 mm), (694 nm, variable, 10-100 J/cm^2, 7-10mm chill tip), long pulsed alexandrite laser (755 nm, 3 ms, 10-60 J/cm^2, 10mm) and long pulsed diode laser (800 nm, 5-20 ms, 9 mm, 10-40 J/cm^2,chill-tip) at producing hair removal.
Method: 11 test sites were mapped in 20 light skinned (type I-III) dark haired subjects. After baseline hair counts were obtained, subjects received a single treatment to 10 test areas (two treatments were done with each laser at both the maximum tolerated fluence and the minimum fluence available). Hair counts and follow up photographs were obtained one, three, six, nine and twelve months after treatment.
Results: A growth delay was seen at all laser treated sites. A 10-30% long term hair loss was seen at the highest tolerated fluence of all light sources tested. Transient pigmentary changes that were seen at 3 month follow up visits in some subjects had generally resolved at 6 months.
Conclusion: Safe and effective long term hair loss may be achieved with all lasers tested.

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INTRADERMAL TEMPERATURE MEASUREMENTS DURING LASER-ASSISTED HAIR REMOVAL: THE EFFECTS OF DERMAL COOLING.

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Purpose: To measure the intradermal temperature changes produced during laser-assisted hair removal and to study the effect of dermal cooling on these changes.

Methods: An 810 nm diode laser (Nidek, Inc., Freemont, CA) was used to treat black farm pigs at a fluence of 48 J/cm^2 (power= 60W, pulse duration= 100ms, spot size= 4mm) with varying spot overlap (density= 0-30%). Four experimental groups were established: treatment at room temperature, treatment through sapphire at room temperature, treatment through sapphire at 15°C and treatment through sapphire at 5°C. A cryogen-cooled sapphire window (DermaCool Distributors, Atlanta, GA) was used to cool the skin. Intradermal temperature was measured 0.7, 1.5, and 3.0mm below the skin's surface. Temperature was measured using a chart recorder sensitive to within 0.5°C and samples were taken every 2 ms.

Results: As expected, at each point measured the ΔT increased linearly as the spot density increased (P<0.0001). Second, at each temperature tested the greatest ΔT was measured 1.5 mm below the skin's surface (P<0.0001). This may be explained by postulating the formation of intradermal steam that is largely confined to this level, especially when the skin is occluded the sapphire cooling tip. The finding that the ΔT was far greater under cooled or room temperature sapphire supports this. Third, the ΔT measured 1.5 and 3.0 mm below the skin's surface was greater when the skin was cooled to 5°C than when it was cooled to 15°C (p<0.0001). This is entirely counterintuitive. We postulate decreased intradermal blood flow induced by the cooler temperature as being responsible for this observation.

Conclusion: Intradermal temperature change increased as expected when the packing density of laser spots was increased. The ΔT is greatest 1.5 mm below the skin's surface and may be increased further by placing the skin under occlusion with a contact-type laser handpiece. The temperature change 3.0 mm below the skin's surface increases as the skin is cooled from 15°C to 5°C, an observation that may be related to dermal blood flow.

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CO_2 LASER RESURFACING OF TATTOOS PRIOR TO Q-SWITCHED LASER TREATMENT

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The purpose of this study was to determine whether CO_2 laser resurfacing of tattoos prior to Q-switched laser treatment achieves a greater degree of tattoo lightening with an acceptable side effect profile. Nine adult patients with professional tattoos were enrolled in a controlled, prospective study. Tattoo location was as follows: four on the upper arm, three on the forearm, one on the back, and one on the ankle. Each tattoo was divided into four quadrants of approximately equal size, color, and ink density. Three quadrants received different treatments while the fourth quadrant served as a non-treated control. The first quadrant was treated with one pass of the Ultrapulse CO_2 laser followed by a wet gauze wipe (CPG at 300 mJ, density 5 or 6). The second quadrant was treated with one or more Q-switched (QS) lasers depending on tattoo color (QS ruby with 6.5 mm spot size, fluence of 4.5 J/cm^2; QS alexandrite with 3 mm spot size, fluence of 4.8-6 J/cm^2; 1064 nm QS Nd:YAG with 3 mm spot size, fluence of 4.6-5 J/cm^2; 532 nm QS Nd:YAG with 3 mm spot size, fluence of 2.4-2.8 J/cm^2). The third quadrant was treated with one pass of the CO_2 laser followed by treatment with QS lasers using identical settings as in quadrants 1 and 2. Postoperative care consisted of wet gauze compresses and application of occlusive ointment. Five patients were treated with prophylactic antibiotics postoperatively after two cases of infection were noted in patients not receiving antibiotics. Areas of incipient textural change were treated with Ultravate ointment. Each patient was followed for a minimum of two months. One patient was enrolled in the study a second time after a follow-up of two months. Clinical results were judged based on patient opinion, investigator evaluation, and comparison of pre and post-treatment photographs. Five patients observed pigment on their dressings postoperatively. All patients reported considerable discomfort in the postoperative period. In two patients, a greater degree of tattoo lightening was achieved with the combination CO_2/QS laser treatment than with QS lasers alone. In the remaining patients, there was no appreciable difference. Quadrants treated with the CO_2 laser alone exhibited minimal to no lightening. Six patients developed textural change in the CO_2/QS laser quadrant, while more subtle textural change was seen in three patients in the CO_2 laser alone quadrant. Postoperative infection was observed on the ankle and upper arm in two of four patients not given prophylactic antibiotics. While the combination of CO_2 and Q-switched laser treatment may enhance tattoo lightening in a minority of patients, the disadvantages far outweigh the advantages for most patients. The treatment of resurfaced skin with QS lasers significantly raises the risk of textural change. Other drawbacks include prolonged operative time, absolute need for local anesthetic, increased postoperative discomfort and prolonged healing time, and increased risk of infection.

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QUANTITATIVE CHEMICAL ANALYSIS OF TATTOO PIGMENTS

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Purpose: To identify the elemental composition of 30 tattoo pigments commonly used by present-day artists.

Methods: An elemental assay of tattoo pigments was performed by scanning electron microscopy with energy dispersive X-ray analysis. The material safety data sheet (MSDS) for each of the pigments was reviewed and a list of the elemental constituents was compiled. The elemental composition obtained by chemical analysis was compared to the results compiled from the MSDS.

Results: Of the 30 tattoo inks, the most commonly identified elements were aluminum (87% of pigments), oxygen (73% of pigments), titanium (67% of pigments), and carbon (67% of pigments). The relative contribution of elements to the ink compositions was highly variable between different compounds. Overall, the material safety data sheets were consistent with the elemental analysis, but there were important exceptions.

Conclusion: The composition of elements in tattoo inks varies greatly, even among like-colored pigments. Knowledge of the chemical composition of popular tattoo inks might aid the clinician in effective laser removal.

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DIODE (810 NM) LASER TREATMENT OF PIGMENTED LESIONS

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Pigmented lesions have been treated with many wavelengths well absorbed by melanin. 532 nm with the shorter wavelength has excellent melanin absorption but has only shallow penetration. 694 and 755 nm continue with excellent melanin absorption and these longer wavelengths allow deeper penetration. Even the 1064 nm QS Nd:YAG has been shown to target melanin in nevus of Ota. The 810 nm Diode laser (Coherent) is already FDA approved for permanent hair removal. We studied its ability to target nevocellular nevi as well as other benign pigmented lesions. 25 subjects with Fitzpatrick skin types I-IV were enrolled in a prospective controlled clinical study. Subjects with dysplastic nevi or personal or family history of melanoma were excluded. Each lesion was treated with 30-40 J/cm2 with pulse widths of 15-30ms. Up to 3 treatments at 4-8 week intervals were performed. The percent of lightening was graded and any side effects were noted. After 1 treatment 14/25 were less than 50% clear, however 11/25 were >50 % clear and of these 5/25 were greater than 75% clear and 2 were >95% clear. After 2 treatments 11/25 nevi cleared greater than 75% and 6/25 were > 95% clear. Results after the 3rd treatment and 6 month data will be presented. Two subjects (both with a tan) had temporary hypopigmentation which cleared within 2 months. Interestingly these nevi cleared with fewer treatments.

Three patients had mild hyperpigmentation which cleared quickly with topical hydroquinone. This study demonstrates that the Coherent Diode (810 nm) laser is safe and effective for treatment of nevi. Higher fluences and shorter pulse widths were more effective. Side effects were minimal and treatment with the 810 nm Diode was safe even for darker skin types.

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Title: Effect of Q-switched and long pulsed lasers on congenital melanocytic nevi.

Authors: Arielle N.B. Kauvar and Wendy W. Lou

Methods: Treatment of congenital melanocytic nevi remains difficult, and often results in incomplete pigment clearance or delayed repigmentation.

Purpose: The purpose of this study is to evaluate the tissue effect of nanosecond and millisecond duration lasers on congenital melanocytic nevi.

Results: Congenital melanocytic nevi were treated with frequency doubled Q-switched Nd:YAG (532 nm, 5 nsec), Q-switched ruby (694 nm, 28 nsec), Q-switched alexandrite (755 nm, 60 nsec), Q-switched Nd:YAG (1064 nm, 5 nsec), long pulsed ruby (694 nm, 3 msec), alexandrite (755 nm, 3 msec), and Nd:YAG (1064 nm, 10 msec) lasers.

Incisional biopsies were obtained immediately after, and at 2 and 4 weeks post-treatment.

Conclusion: The relative depths of pigment dissolution and degree of lesional lightening are assessed. Laser treatment guidelines for improved efficacy are provided based on these results.

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THE CLINICAL EFFICACY AND LONG TERM COMPLICATION OF Q-SWITCHED ALEXANDRITE (QS ALEX) AND Q-SWITCHED NEODYMIUM: YTTRIUM-ALUMINUM-GARNET (QS ND:YAG) IN THE TREATMENT OF NAEVUS OF OTA

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The purpose of the study was to assess the clinical efficacy and long term complication of Q-switched Alexandrite (QS Alex) and Q-switched Neodymium: Yttrium-Aluminum-Garnet (QS Nd:YAG) in the treatment of Naevus of Ota.

Patients with naevus of Ota undergoing laser therapy in two laser centers were recruited into the study. QS Alex, QS Nd:YAG or a combination of both lasers were used for their treatment. Patients are asked to self-assess the degree of lightening using a structured questionnaire. Two clinicians (a dermatologist and a plastic surgeon) examine the patients independently to look for signs of complications. Finally pre-treatment and post-treatment photographs, clinical photographs are taken so that a panel of experts could assess the degree of lightening and complications.

Our preliminary results indicated that of the 139 patients so far participated, pigmentary disturbance, texture changes and scarring occur in 19%, 4% and 1% respectively. 22.5% of the patients had moderate degree of clearing (defined as 25 to 50% of improvement), 37.5% had significant or excellent degree of clearing (defined as more than 50 % improvement). Using chi square test, the complication rate and clinical response of patients receiving QS Alex, QS Nd:YAG and a combination of both lasers were compared. The results indicated that there was no significant difference (p=0.399) in term of complication rate. Combination of both lasers achieved the best clinical response (p=0.0001) but such differences was related to the number of treatment sessions rather than the type of laser used. (multiple regression analysis, p=0.009 for the number of treatment sessions and p=0.9127 for the type of laser used).

We concluded that both QS Alex and QS Nd:YAG laser were equally effective in the treatment of nevus of Ota. The number of treatment sessions rather than the type of lasers used seem to be the main determining factor for both the complication rate and the clinical outcome.

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Title: Effect of cryogen spray cooling on 595 nm, 1.5 msec pulsed dye laser treatment of port wine stains.

Authors: Arielle N.B. Kauvar, Wendy W. Lou, and Brian Zelickson

Methods: Previous studies have demonstrated that cryogen spray cooling decreases treatment discomfort and permits the safe use of higher fluences in the treatment of port wine stains.

Purpose: The purpose of this study is to quantify the increase in lesional lightening and the reduction in treatment discomfort provided by the use of cryogen spray cooling with increased laser fluences.

Results: Ten subjects (age > 6 months) with previously untreated port wine stains were evaluated in the study. Each port wine stain was trisected so that a minimum 3 x 3 cm area would receive (i) laser treatment at fluences of 11-15 J/cm^2 (7 mm spot) with cryogen cooling, (ii) laser treatment at the highest tolerated fluence without cooling and (iii) no treatment. Subjects were followed at 3, 7, 30 and 60 days. Serial digital and 35 mm photographs were obtained and assessments were made regarding the degree of pain, purpura, pigmentary damage and clearance using a quartile grading system.

Conclusion: Higher fluences used with cryogen cooling resulted in increased port wine stain clearing. The relative improvement in the treatment course as well as the degree of increased lesional lightening provided by the cryogen cooling is discussed.

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VASCULAR LESION TREATMENT UTILIZING A PULSED DYE LASER AT HIGH FLUENCES IN COMBINATION WITH CRYOGEN SPRAY COOLING

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The purpose of this study was to determine the effectiveness and the incidence of side effects during high fluence (10-15 J/cm^2) treatment of vascular lesions with the 1500 μs pulsed dye laser in combination with cryogen spray cooling (CSC).

Patients with port wine stains (PWS) and hemangiomas were treated with the ScleroPLUS® pulsed dye laser in combination with CSC utilizing the following laser parameters: wavelength = 585 or 595 nm;

spot size = 7mm; fluence = 10-15 J/cm^2; cryogen spurt duration = 30-60 ms; cryogen delay: 10-30 ms. Improvement and side effects were documented by clinical observation and standardized photography. Independent observers determined the percent improvement by blinded comparison of before and after photographs at the conclusion of the study.
Significant improvement was noted in all lesions including those previously resistant to treatment. The higher fluences resulted in more rapid lesional improvement. Significant side effects were uncommon. CSC in combination with the 1500 μs pulsed dye laser achieves rapid and effective treatment of vascular lesions while maintaining a high safety profile and thus, should be considered the treatment of choice.

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QUANTIFYING POSTOPERATIVE PAIN REDUCTION UTILIZING THE DYNAMIC COOLING DEVICE TO TREAT PEDIATRIC PATIENTS WITH PORT WINE STAINS
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The addition of the dynamic cooling device (DCD) to pulsed dye laser treatment has enabled the laser surgeon to more effectively treat vascular lesions by maximizing energy fluences and minimizing discomfort and bruising. Previous studies of DCD – associated pain reduction have focused on the intraoperative period, as evaluated by the patients themselves on a numeric scale. We sought to more objectively quantify the reduction in pain by assessing postoperative analgesic requirements among pediatric patients undergoing treatment of port wine stains (PWS) before and after the DCD was introduced at our institution.
A retrospective query of the University of Michigan pediatric PWS database yielded seven patients that met the pre-determined selection criteria: 1) treatments both before and following the introduction of the DCD; and 2) age >3 years so that pain experienced specifically in laser-treated areas could be articulated by the patient. All subjects were treated under general anesthesia in the children's hospital operating room. Age, sex, PWS location and size, Scleroplus laser parameters ± DCD, anesthesia agents, analgesic medications administered in the post anesthesia care unit (PACU), and duration spent in the PACU prior to discharge were recorded. Paired t-tests were performed on PACU medication and PACU duration data with and without the DCD.
Without the DCD, our patients required more morphine per treatment than with the cooling apparatus (1.64 ± 0.65 vs. 0.19 ± 0.12 mg, respectively, $p < 0.05$). Laser energy fluences utilized were slightly higher with the DCD. There was no statistically significant difference in length of time spent in the PACU. Our study supports the premise that the DCD reduces postoperative pain induced by the pulsed dye treatment of PWS by comparing the actual analgesic requirements before and after DCD availability. Multi-institutional database reviews or prospective studies conducted at institutions before and after a DCD is procured could further quantify pain reduction.

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EFFICACY OF PULSED DYE LASER TREATMENT OF PORT WINE STAIN MALFORMATIONS ON THE UPPER LIMB.
Jane Ravenscroft, Rajini Mahendran, Rob Sheehan-Dare, Leeds Dermatology Laser Centre, Leeds, UK.
There have been few reports of PDL treatment of PWS on the upper limb. We report on our experience of 15 patients in 36 areas (upper arm, forearm, hand, fingers). Improvement was assessed by comparison with baseline photographs, using a scale of (75-100%), (50-75%), (25-50%), and (0-25%). Patients/parents also made a subjective assessment on a scale of 0 to 10. Treatment was partially effective for the upper arm in all patients, with a median of 3 treatments rated 75-100% in 1 patient and 25-50% in 9. Median patient assessment score was 7. For the forearm, a median of 6 treatments gave a 75-100% response in 1, 50-75% in 2, 25-50% in 3, and 0-25% in 6, with a median patient assessment score of 7. 9 patients had treatment to the hand with a median of 3 treatments and responses of 75-100% in 2, 25-50% in 1, and 0-25% in 6. Median patient assessment score was 8. The fingers were treated in 5 patients with 3 treatments giving a 0-25% response in 4, and 25-50% in 1, and patient scores correspondingly poor, median 9. Adverse effects were not seen on the upper arm or hand. 7 of 12 suffered at least one adverse effect on the forearm, with hyperpigmentation in 4, atrophic scarring in 2, and hypertrophic scarring in 2. 3 patients receiving hand treatment suffered hyperpigmentation on one occasion. This study confirms that responses to PDL treatment of upper limb PWS are better in more proximal lesions. Improvement appears to be less than seen on the face and lower limbs, and the scarring risk is higher. Treatment of the fingers produced modest improvement in all patients, whereas some patients with hand, forearm and upper arm lesions had worthwhile improvements. PDL treatment of upper limb PWS is worth trying, but patients must be aware that relatively modest improvements occur in the majority of cases.

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Title: Long Term Follow-up for Recurrences of Port Wine Stains Previously Treated by Lasers

Authors: Wendy W. Lou, Arielle N.B. Kauvar, Roy G. Geronemus
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Purpose: To determine the recurrence rate of port wine stain previously treated primarily by pulsed dye laser.

Methods: Twenty adults patients with port wine stains who were previously treated with lasers, primarily the pulsed dye laser, were evaluated. The mean follow-up is approximately 7 years with a range of 5 to 10 years after their last treatment. Patients were asked if they noticed any subjective clinical recurrence of their lesion since the last treatment and when possible were compared to clinical photographs.

Results: Few patients reported partial recurrence of their port wine stain since the last laser treatment although most had no recurrence. A lower than expected incidence of vascular blebs was seen compared to untreated lesions of that population.

Conclusion: Long term follow-up shows long term benefit of previously treated port wine stains.

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Title: Treatment of Hemangiomas with 595 nm, 1.5 millisecond Pulsed Dye Laser (ScleroPlus Laser, Candela, Wayland, MA)

Authors: Wendy W. Lou, Arielle N.B. Kauvar, Roy G. Geronemus
Laser & Skin Surgery Center of New York

Purpose: To determine the safety and efficacy of the new 595 nm, 1.5 millisecond pulsed dye laser with Dynamic Cooling Device (DCD).

Methods: Forty patients were treated with the ScleroPlus Laser (Candela, Wayland, MA). The patients were treated at 3 to 5 week intervals. The stage of hemangioma, proliferative verses involuting were noted during treatment. Evaluation of overall clearance was done on a quartile scale (0:0 to 25%, 1:26 to 50%, 2:51 to 75%, 3:76 to 100%). The area of maximum clearance was also rated on the same scale.

Results: An average of 7.5 treatments were done with a range of 1 to 26 treatments. Significant clearance was noted. Lesions in the proliferative stage appear to require shorter intervals of treatment. Superficial hemangiomas and superficial portion of the deeper components of hemangiomas appear to respond well to ScleroPlus laser treatment. A greater than anticipated response was seen with the deeper component of these lesions. Side effects were minimal and transient.

Conclusion: The ScleoPlus laser is safe and effective for the treatment of hemangiomas in both proliferative and involuting stages. Side effects were minimal.

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A RARE COMPLICATION OF PULSED DYE LASER TREATMENT OF HEMANGIOMAS

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Purpose: To determine the frequency of ulceration induced by pulsed dye laser treatment of hemangiomas.
Method: A retrospective chart review of 500 neonates, infants and children with hemangiomas and treated with a pulsed dye laser was undertaken.
Results: 12 patients were identified in whom PDL treatment resulted in severe and widespread ulceration within hours of the treatment. All of these patients had diffuse hemangiomas and all were neonates in whom the lesions were in the early proliferative phase. Three already had minor ulceration (small ulcers, 3mm or less) at the time of treatment and this was the premise for treatment in these cases.
Conclusion: A small subgroup of patients with diffuse early, rapidly proliferating hemangiomas has been identified in whom PDL treatment may well be harmful.

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THE USE OF A NEW LONG PULSED DYE LASER FOR THE TREATMENT OF FACIAL TELANGIECTASIAS

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Pulsed dye lasers have been used for over a decade to treat vascular lesions. The efficacy is good, but patients experience significant purpura which can last 7-14 days. Theoretically, a pulsed dye laser with a longer pulse duration is expected to produce less mechanical rupture of the vessels and thus less purpura. Such a laser, however, has not been available until now. In this study, a new and experimental pulsed dye laser with a longer effective pulse duration was compared to a standard pulsed dye laser for the treatment of facial telangiectasias.

Twenty consenting patients with facial telangiectasias with skin types I-III were enrolled in the study. For each patient, some vessels were treated with a standard pulsed dye laser (λ = 589 nm, pulse duration 450 μsec, fluences 6.0 - 7.25 J/cm^2, Candela Corp., Wayland, MA). Other vessels were treated at either 10 ms or 20 ms pulse duration using a modified pulse dye laser (λ = 589 nm, Candela Corp., Wayland, MA). Assessment for purpura and vessel clearance was done at 1 day, 4 days, 7 days, 14 days, and 2 months. 6 month follow-up is available for some of the patients.
The longer pulse duration laser produced less purpura with equal or better vessel clearance than the standard pulsed dye laser.
In conclusion, the treatment of facial telangiectasias is enhanced with a longer pulse duration pulsed dye laser.

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810 NM DIODE LASER TREATMENT OF FACIAL TELANGIECTASIA

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The purpose of this study was to evaluate the safety and efficacy of the 810 nm diode laser for treatment of facial telangiectasia.
20 patients with facial telangiectasia were treated with the diode laser (LaserLite, DIOMED Ltd., United Kingdom). Patient skin types were graded using the Fitzpatrick classification. The following treatment parameters were used: spot size of 2 mm, fluences of 55-70 J/cm^2, pulse duration of 50 msec, and pulse interval of 200 msec. A sapphire tip cooling device (DermaCool, OptoMed, Inc., Austin, TX) was used to cool the skin temperature to 4 degrees C. Patients were evaluated 2 and 4 weeks following treatment. Subjective grading was performed at each follow-up visit by the investigators and blinded objective grading was performed at the conclusion of the study by trained observers. Patients completed questionnaires assessing discomfort, effectiveness, side effects, and overall satisfaction.
95% (19/20) of patients demonstrated good to excellent (70%-100%) clearance of their facial telangiectasia after one or two treatments. 12 patients were treated a second time. Patient satisfaction was excellent in 95%. No persistent side effects or complications were noted.
The 810 nm diode laser is a safe and effective treatment for facial telangiectasia without the post-treatment pupura or post-inflammatory hyperpigmentation that can be seen following treatment with some other lasers. The 810 nm wavelength may also allow a wider range of skin types to be treated.

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DIODE LASER TREATMENT OF CUTANEOUS SMALL VESSELS AT 980NM

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Varying laser light parameters to enhance cutaneous vascular lesion therapy has been in a continued state of evolution. Attempting to increase depth of penetration, while maintaining blood vessel selectivity and safety, is a desired goal of laser therapy. Not only will deeper vessels be impacted, but larger diameter vessels may be treatable. A diode laser at 980nm, with a spot size of 1.5mm, was used to treat 30

subjects with leg veins and nasal telangiectatic vessels. Leg vein sizes varied from 0.3 to 1mm in diameter, while nasal vessels were 0.3 to 0.6mm. Pulse durations of 40 to 100ms, using powers of 25 to 50w, with energy densities ranging from 113J/cm^2 to 141J/cm^2, were chosen for therapy. After 3 treatment sessions, 8 patients had an average of greater than 70% lightening, 14 patients had 40 to 70%, and 8 patients less than 40% lightening. At 2-month follow up, there was no pigmentary or skin texture changes. Optimum power and pulse duration settings may still not have been discovered to maximize therapeutic outcome using this wavelength. However, even at the current studied parameters, there was moderate, to good, vascular response, with a good safety profile.

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HIGH SPEED IMAGING OF MICROVESSELS DURING LONG-PULSE KTP LASER (532NM) EXPOSURE

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Safe and effective laser treatment of vascular lesions has been possible based on the theory of *selective photothermolysis*, which was introduced by Anderson and Parrish over a decade ago. Several different wavelengths, which are absorbed by oxy or deoxy-hemoglobin, have been used for this purpose. Most of these laser systems deliver pulses ranging from several hundred microseconds to milliseconds. Because the thermal relaxation time of vessels measuring 100 mm to several mm in diameter is longer than 10 ms, pulse widths in the millisecond range are ideal for treating various ectactic blood vessels.
Recently we investigated the exposure duration and fluence dependence of microvascular response to 532 nm, millisecond laser pulses in venules and arterioles of albino rabbit ears in three diameter ranges (50-150mm, 200-400mm and 1mm). Clinical and histologic assessment of vessel injury clearly showed that KTP laser exposures in the 1 to 50 ms range, cause selective thermal injury of cutaneous microvessels. With the histologic picture of empty selectively-coagulated vessels, we proposed that the process of "gentle" intravascular vaporization occurs during the ms KTP laser pulses.
The objective of this study is to investigate the intravascular changes during ms KTP laser pulses and confirm the intravascular vaporization process. For this purpose, we captured high speed images of hamster cheek pouch vessels during and after KTP laser pulses.
Preliminary results show that cavitation in 80 to 160 μm vessels following 10 ms KTP laser pulses start 1 to 2 ms after the initiation of the pulse and last, depending on the fluence, from 7 to 17 ms.

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PULSED-DYSE LASER (600-NANOMETER, 1.5 MILLISECOND PULSE DURATION) TREATMENT OF DERMATOFIBROMAS. Peter K. Lee, Whitney D. Tope. Department of Dermatology. University of Minnesota, Minneapolis, Minnesota.

Dermatofibromas are benign fibrous tumors of the skin that most commonly occur on the lower extremities of women. Previously, successful treatment of these lesions has been limited mostly to surgical excision, often resulting in cosmetically unacceptable scars.
In this study, we hypothesized that the pulsed-dye laser (600nm, 1.5ms pulse duration) is an effective method of treatment of dermatofibromas.
We prospectively treated 20 dermatofibromas of the leg(s) (17 females, ages 22 to 66) with the pulsed-dye laser (600nm, 1.5ms pulse duration; Cynosure) at a fluence of 7 J/cm^2, 7 mm beam diameter. Every lesion was double pulsed at each treatment visit and was treated up to three times 6 weeks apart. Pre-treatment and post-treatment biopsies using a 2-mm punch were obtained for histologic comparison in 4 lesions.
All 20 dermatofibromas decreased in volume after a single treatment. The volume of the lesions continued to decrease after second (18 lesions) and third (10 lesions) treatments. The color of the dermatofibromas improved in only 10 of 20 lesions. All symptomatic lesions (6) had resolution of symptoms after treatments. Complications included blistering and post-inflammatory hyperpigmentation. Histologic analysis showed a reduction in the amount of spindle cell fascicles that are present in dermatofibromas.
In conclusion, pulsed-dye laser (600nm, 1.5ms pulse duration) treatment was effective in treating dermatofibromas of the lower extremities. This treatment method provided a successful alternative to surgical excision for treatment of dermatofibromas.

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COMPARISON OF PULSED DYE LASERS (585 NM / 0.45 MS VERSUS 600 NM / 1.5 MS) FOR HYPERTROPHIC SCARS

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The original pulsed dye laser (PDL – 585 nm, 0.45 ms) is an established and effective method for improving hypertrophic scars (HS). PDL's effectiveness is thought to derive from injury to scar vasculature causing altered collagen metabolism mediated by scar fibroblasts. PDL's capable of producing longer wavelength and pulse duration are now available. The reduced hemoglobin absorption coefficient and enhanced tissue penetration of 600 nm light and the ability to successfully treat larger diameter vessels with 1.5 ms pulses might produce an improved clinical response in HS Four patients (Fitzpatrick types I-IV) with symptomatic HS on the trunk and proximal extremities were treated. Scars were 4-12 years old and untreated by other methods within the preceding 3 months. Individual or grouped scars were divided in half and treated with equivalent fluences (+/- 5%) employing minimally overlapping (<10%) pulse delivery. One half was treated with 600 nm/1.5 ms (7 mm, 4.9-7.0 J/cm^2) and the other half with 585 nm/0.45 ms (7 mm, 4.9-7.1 J/cm^2) laser energy (VLS, Cynosure, Chelmsford, MA). Two or three treatments occurred at 1-2 month intervals. Patients judged clinical improvement based upon color (erythema and melanin), degree of induration, and change in symptoms (pain, pruritus). If patients judged that either laser created significantly greater improvement and/or had more acceptable side effects, that laser would be selected for subsequent treatments. Both lasers caused pain on pulse delivery, occasional blistering, and immediate purpuroid change. Purpuroid change resolved within 5-7 days or 10-14 days with 600 nm/1.5 ms or 585 nm/0.45 ms laser, respectively. After 2 or 3 treatments, each patient judged clinical improvement significantly greater with 585 nm/0.45 ms laser treatment. This was true despite the more prolonged purpuroid change. In this small population, 585 nm/0.45 ms PDL caused greater clinical improvement in symptomatic HS than 600 nm/1.5 ms PDL. This suggests that HS vessel size (T_r) is more appropriate to treatment at 585 nm/0.45 ms or that fibroblasts may absorb 585 nm energy to a greater extent than 600 nm energy.